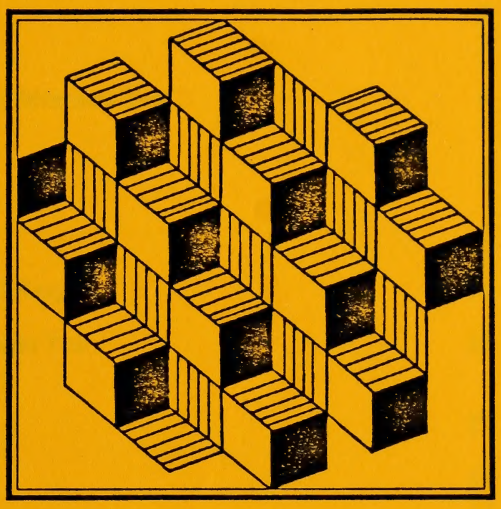
L.1.1248 c.2

NOV 27 1991

Student Achievement Testing Program Bulletin

Grade 9 Mathematics



1991-92 School Year

Students First!

Student Evaluation

Alberta EDUCATION

This bulletin contains general information about the 1992 Student Achievement Testing Program, and information specific to the Grade 9 Mathematics Achievement Test. Additional copies of this bulletin may be obtained by telephoning Alberta Education at 427-0010.

DISTRIBUTION: Superintendents of Schools • School Principals and Teachers • The Alberta Teachers' Association • Alberta School Boards' Association • Officials of Alberta Education • General Public upon Request

September 1991

Table of Contents

	Page
GENERAL INFORMATION	1
Reporting Achievement Test Results	1
Broadened Assessment Initiatives	2
GRADE 9 MATHEMATICS ACHIEVEMENT TEST	2
General Description	2
Content of the Test	2
Confirming Standards	3
Blueprint of Grade 9 Mathematics Achievement Test	4
SAMPLE QUESTIONS	5
Part A: Multiple-choice	6
Part B: Numerical Response	13
Practice Answer Sheet for Numerical Response	14
Cognitive Levels Indicators for the Grade 9 Mathematic Achievement Test	18
PERFORMANCE STANDARDS	19
Purpose of Performance Standards	19
Target Group	19
Acceptable Standard	19
Standard of Excellence	20
ALBERTA EDUCATION CONTACTS	21

Digitized by the Internet Archive
in 2016

https://archive.org/details/studentachieveme00albe_17

GENERAL INFORMATION

The Achievement Testing Program provides Alberta Education, school jurisdictions, and the public with information significant at the provincial and local levels about what students know and can do in relation to objectives of the *Program of Studies*. It does not provide information to be used for student placement or promotion.

The achievement tests are administered on a four-year cycle in four subject areas: language arts, social studies, mathematics, and science; and at three grade levels: 3, 6, and 9.

The achievement tests are specific to the *Program of Studies* prescribed by the Minister of Education. Classroom teachers from across the province are extensively involved in developing and field testing the questions.

Information pertaining to the nature and administration of the Achievement Testing Program, exemptions, and students receiving instruction in French can be found in the *Achievement Testing Program General Information Bulletin, 1991-92*,which has been mailed to all superintendents and principals.

During 1992, the achievement tests will be administered according to the following schedule:

Tuesday, June 9, 1992

Grade 3 Social Studies (a.m.)

Grade 6 English Language Arts — Part A: Writing (a.m.); Part B: Reading (p.m.)

Grade 9 Mathematics* (a.m.)

Thursday, June 11, 1992

Français 6e Année — Part A: Writing (a.m.); Part B: Reading (p.m.)

* A French translation of this test is available and must be administered at the same time as the English test. Schools will be sent enrolment forms from Alberta Education by February 1992 requesting an indication of which test versions are required (English/French). These forms must be returned through jurisdiction offices by March 6, 1992.

Reporting Achievement Test Results

In September 1992, each school jurisdiction will receive a district profile and school reports for their students' achievement, as well as guidelines for interpreting these results in relation to provincial standards.

In December 1992, provincial results will be made public through the annual *Provincial Report, Achievement Testing Program.*

Broadened Assessment Initiatives

During the past year, the Student Evaluation Branch initiated the development of assessment instruments designed to collect a broader base of information in order to provide a better picture of what students know and can do. This development resulted in the field testing of these instruments in the spring of 1991.

- Grade 3 - across curriculum portfolio assessment
  - across curriculum thematic test
- Grade 6 - performance tasks in mathematics and science
  - aural communication skills in language arts
- Grade 9 - performance tasks in mathematics and science
  - participation skills in social studies

Later this fall, information describing the above broadened assessment instruments will be communicated to all schools and jurisdictions. This will include examples from the instruments and some preliminary results of student performance. The Student Evaluation Branch will continue to develop, revise, construct, and field test broadened assessment instruments in the coming year. For further information, contact Greg Hall, Acting Program Manager, Achievement Testing Program at 427-0010.

GRADE 9 MATHEMATICS ACHIEVEMENT TEST

General Description

The Grade 9 Mathematics Achievement Test is designed to reflect the content and skill objectives in the *Teacher Resource Manual, Junior High Mathematics, 1988.*

The test consists of two parts:

Part A has 40 multiple-choice questions each with a value of one mark.
Part B has 10 numerical-response questions each with a value of one mark.

Students will record answers to questions on machine-scored answer sheets.

Students will have two hours to write the test. We suggest those students who finish writing before one hour has elapsed remain in their desks to review their answers.

Students will require HB pencils, rulers, and erasers. They will also need scrap paper.

Calculators are highly recommended.

Content of the Test

The six strands in the core program of the Grade 9 Mathematics curriculum in which problem solving is an integrated component, and the emphasis that each strand is to receive according to the *Teacher Resource Manual, Junior High Mathematics, 1988,* form the basis for the Achievement Test.

Confirming Standards

Confirming standards is a process whereby judgments about students' performance on the achievement test are made in relation to provincial standards. For more information on confirming-standards procedures, refer to Appendix C of the *Achievement Testing Program Provincial Report, June 1990 Administration.* For information on the selection of teachers for participation in the confirming-standards process, refer to the *Achievement Testing Program General Information Bulletin, 1991-92.*

Blueprint for the Grade 9 Mathematics Achievement Test

	Knowledge and Skills		Problem Solving and Application		
Taxonomy Strand	Content Knowledge and Quantitative Literacy	Procedural Knowledge	Conceptual Under-standing	Problem Solving	Total Number of Questions and Test Emphasis
Number Systems and Operations	3	2	5	3	13 (26%)
Ratio and Proportion	2	1	3	3	9 (18%)
Measurement and Geometry	2	2	5	2	11 (22%)
Data Management	1	1	4	1	7 (14%)
Algebra	1	3	4	2	10 (20%)
Total Number of Questions and Test Emphasis	9 (18%)	9 (18%)	21 (42%)	11 (22%)	50 (100%)

SAMPLE QUESTIONS

Sample questions that reflect the nature and complexity of the questions that will appear on the 1992 Achievement Test are presented on the following pages.

Teachers are encouraged to familiarize their students with the kinds of questions that will appear on the Achievement Test by having them work through the sample questions. A practice answer sheet for the numerical-response questions has been provided so that students can familiarize themselves with this new form. Please note that this collection of questions does not represent the test emphasis as presented in the blueprint.

The difficulty level of the question, which indicates the percentage of students who answered the question correctly on field tests, is also given. For example, a difficulty level of 0.431 means that 43.1% of the students answered the question correctly.

Questions 1 and 2 are "cluster" questions.

Questions 3 to 11 are discrete questions.

Question 1 to 5 are numerical-response questions.

Part A: Multiple Choice

Use the information below to answer questions 1 and 2.

One student's math test marks were as follows:

35, 38, 72, 73, 73, 90

1. If on the next math test the student gets 33, which of these measures would be **most** affected?

A. Mode
*B. Mean
C. Range
D. Median

Strand: Data Management - using data from meaningful situations (e.g., test marks), students are required to understand and use the terms mean, median, mode, and range.

Taxonomy: Conceptual Understanding

Difficulty: 0.450

2. Which of these measures would be **least** affected?

*A. Mode
B. Mean
C. Range
D. Median

Strand: Data Management - using data from meaningful situations (e.g., test marks), students are required to understand and use the terms mean, median, mode, and range.

Taxonomy: Conceptual Understanding

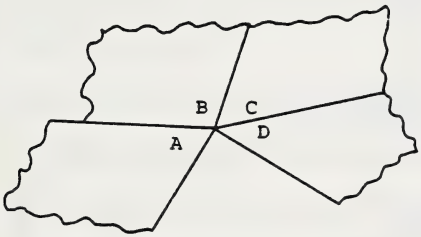
Difficulty: 0.322

Use the information below to answer question 3.

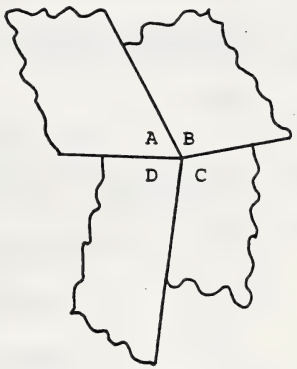
The angles of a quadrilateral are torn off as shown. The vertices of these angles were placed about a common vertex.

3. Which diagram below illustrates the sum of the four angles?

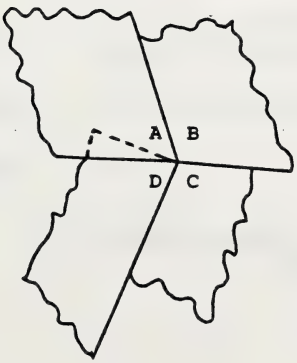
A.



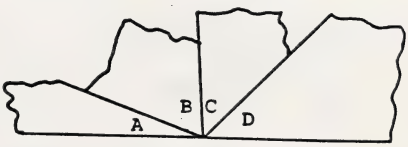
*B.



C.



D.



Strand: Measurement and geometry - students are to determine the sum of interior angles in polygons.

Taxonomy: Content Knowledge

Difficulty: 0.407

4. The gathering of data from a part of the population is call a

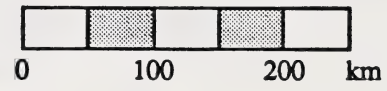
A. prediction
B. statistic
C. census
*D. sample

Strand: Data Management - students are to demonstrate that they have maintained previously developed skills (understand purpose, use and misuse of statistics; biases in surveys)

Taxonomy: Content Knowledge

Difficulty: 0.300

Use the following information to answer question 5.



This bar scale appears on a map.
Measure the bar scale with a ruler.

5. Which scale is equivalent to the bar scale?

A. 1:5 000
B. 1 km to 50 km
C. 1:50 000
*D. 1:5 000 000

Strand: Ratio and proportion - students are required to interpret maps and scale drawings and know conversion of metric units.

Taxonomy: Procedural Knowledge

Difficulty: 0.500

John found the solution to four problems. He wished to verify his solutions.

6. Which equation has the correct solution given?

A. $\frac{b}{-3} + 4 = 7, \quad b = 9$

B. $\frac{c + 4}{2} = 3, \quad c = -2$

*C. $-2(d + 1.5) = 3, \quad d = -3$

D. $1.8e - 2.4 = 3, \quad e = -3$

Strand: Algebra - students are required to verify solutions to equations.

Taxonomy: Procedural Knowledge

Difficulty: 0.654

You have found the volume of a rectangular prism (cereal box), a hexagonal prism (J-Cloth box), and a triangular prism (spectrum prism). You wish to generalize as to how to find the volume of any prism.

7. Which method could be used to find the volume of ANY prism?

A. Square the edge of the base and multiply by the height of the prism.

B. Multiply the perimeter of the base by the height of the prism.

C. Multiply the edge of the base by the height of the prism.

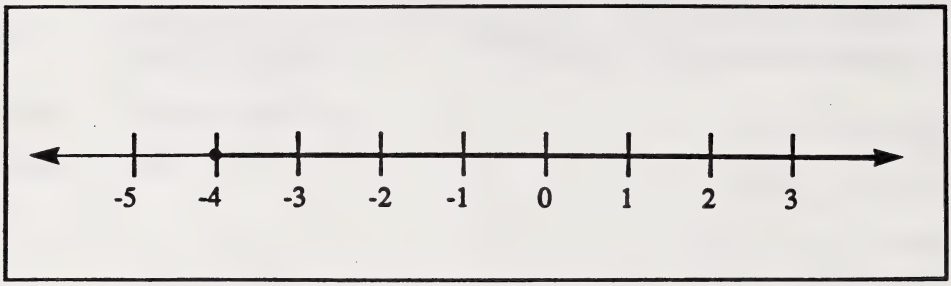
*D. Multiply the area of the base by the height of the prism.

Strand: Measurement and Geometry - students are required to understand and use a strategy for finding the volume of any right prism.

Taxonomy: Conceptual Understanding

Difficulty: 0.589

Use the information below to answer question 8.



When problems involving inequalities are solved, the solution often contains more than one number. To show these numbers, a graph is made.

8. The above is a graph of

   A. $^{-}4 < x < 3$, where x is an integer

   B. $x > {}^{-}5$, where x is an integer

   C. $x \leq {}^{-}4$, where x is a rational number

   *D. $x \geq {}^{-}4$, where x is a rational number

Strand: Algebra - students are required to graph solutions to inequalities on a number line.

Taxonomy: Conceptual Understanding

Difficulty: 0.380

Use the following information to answer question 9.

> A rope that just reaches from the top to the bottom of a well can be wrapped around a cylindrical drum 10 times.

9. How many metres deep is the well if the drum has a diameter of 30 cm?

*A. 9.42
B. 30.0
C. 71.0
D. 94.2

Strand: Measurement and Geometry - students are required to demonstrate that they have maintained previously developed skills, (linear units of measure; perimeter of a circle).

Taxonomy: Problem Solving

Difficulty: 0.330

10. 12 km^2 could be the area of a

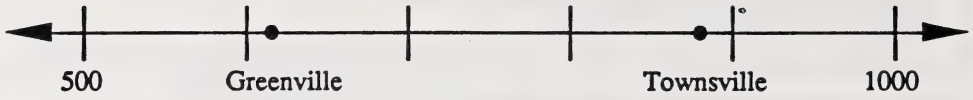
*A. town
B. city block
C. living room
D. baseball diamond

Strand: Measurement and Geometry - students are required to maintain previously developed skills (area).

Taxonomy: Quantitative Literacy

Difficulty: 0.777

11. Which is the best estimate of the distance between the towns shown in the number line below?



A. 50
B. 150
*C. 250
D. 350

Strand: Number Systems and Operations - students are required to use estimation and previously developed skills with whole numbers (operations and ordering).

Taxonomy: Quantitative Literacy

Difficulty: 0.758

Part B: Numerical Response

Instructions: Read each question carefully.

Record your answer on the answer sheet by writing it in the boxes and filling in the circle in EVERY column as illustrated.

Make sure you fill in **all** boxes e.g., and corresponding circle in the column.

0	2	4	3

1. Record only one answer for each question. If you change an answer, erase your first mark completely.
2. Use ONLY an HB pencil to mark your answer.
3. Be sure that the number of the answer sheet matches the question you are doing.

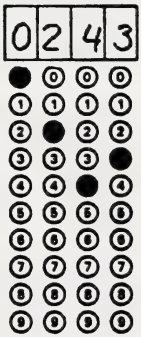
1. Evaluate 3^5

$3^5 = 3 \times 3 \times 3 \times 3 \times 3$

$= 243$

0243 has been recorded for you.

Answer Sheet



2. Each side of an equilateral triangle is 2 cm longer than each side of a square. Their perimeters are equal. Find the length of each side of the triangle.

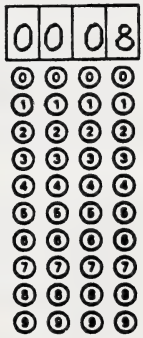
Let x = length of each side of the square.
Then $(x = 2)$ = length of each side of the triangle

$4x = 3(x + 2)$
$4x = 3x + 6$
$4x - 3x =$
$x = 6$

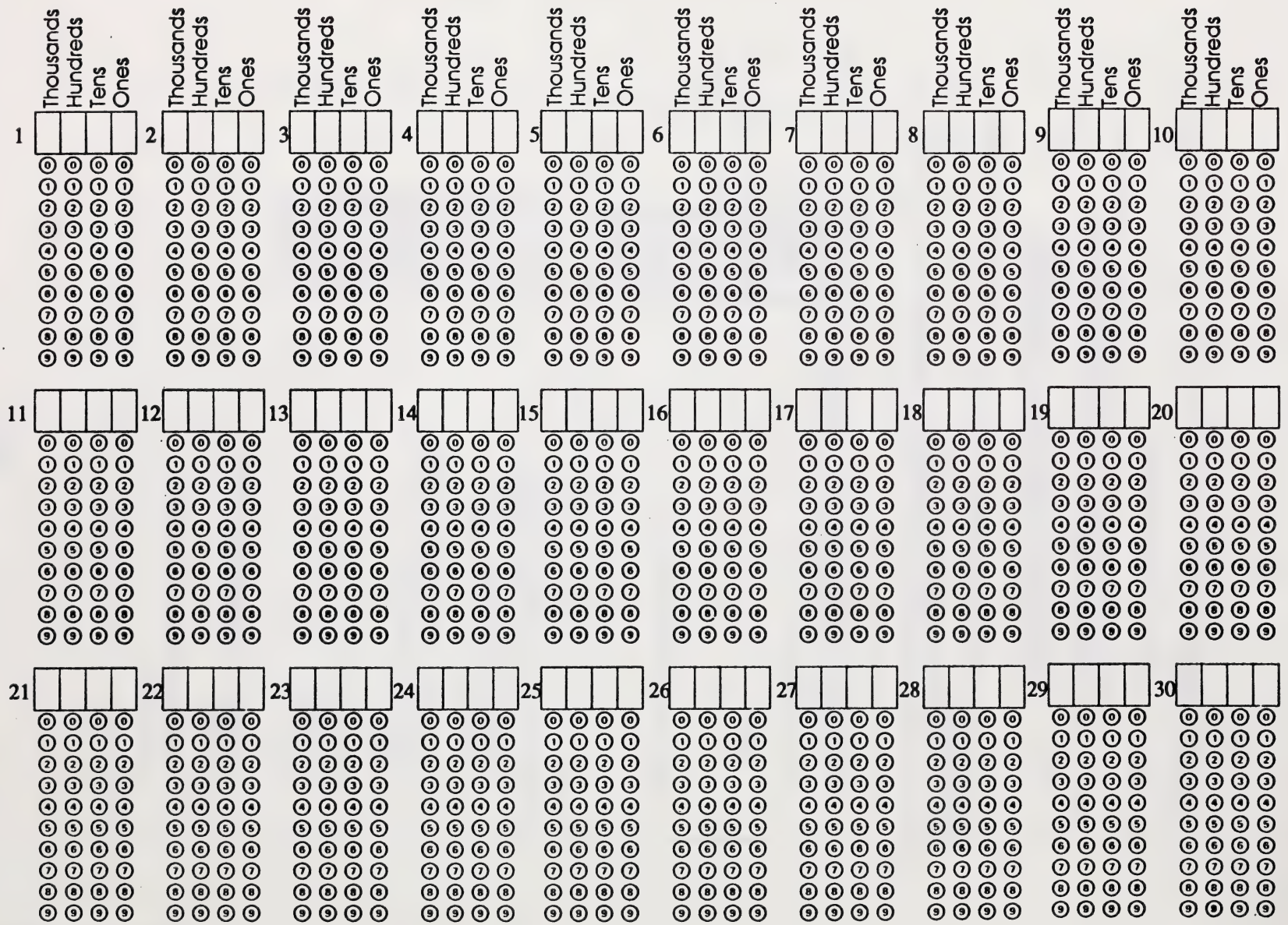
The length of each side of the triangle is 8 cm.

Now, record 0008 on the example on the right.

Answer Sheet



Practice Answer Sheet for Numerical Response



Part B: Numerical Response

1. How many digits were used in numbering the first 103 pages of a book?

RECORD YOUR ANSWER ON THE ANSWER SHEET

Key: 201

Strand: Number Systems and Operations - students are required to apply and practice problem-solving skills in new situations.

Taxonomy: Problem Solving

Difficulty: 0.300

Use the information below to answer question 2.

Jack plays hockey for the local hockey team. He averages six shots on goal per game. One shot of every five results in a goal.

2. If he were to score 360 goals in his career, how many games does he play?

RECORD YOUR ANSWER ON THE ANSWER SHEET

Key: 300

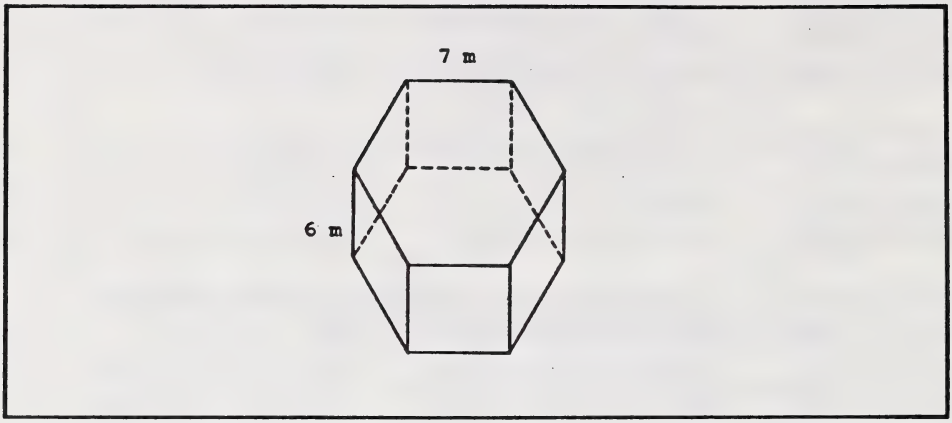
Strand: Problem Solving - students are required to apply and practice problem-solving skills in new situations.

Taxonomy: Problem Solving

Difficulty: 0.300

The area of the base of a silo is 84 m^2.

3. What is its volume?



RECORD YOUR ANSWER ON THE ANSWER SHEET

Key: 504

Strand: Measurement and Geometry - students are to understand and use a strategy for finding the volume of any right prism.

Taxonomy: Conceptual Understanding

Difficulty: 0.305

Use the information below to answer question 4.

The cost of a school ski trip is given by the relation $C = 40n + 200$, where C is the cost in dollars and n is the number of students who attend.

4. If the cost was \$2080, how many students went on the ski trip?

RECORD YOUR ANSWER ON THE ANSWER SHEET

Key: 47

Strand: Algebra - students are required to apply and practise problem solving skills in new situations.

Taxonomy: Problem solving

Difficulty: 0.640

5. A bag contains 400 marbles, some red, some white, and some blue. A random sample contains 8 red marbles, 6 white marbles, and 2 blue marbles. How many of the marbles still in the bag would be expected to be white?

RECORD YOUR ANSWER ON THE ANSWER SHEET

Key: 150

Strand: Data Management - students are required to understand probability.

Taxonomy: Problem Solving

Difficulty: 0.357

COGNITIVE LEVELS INDICATORS (TAXONOMY)

Content Knowledge (K)

- recall of facts, concepts, and terminology

Procedural Knowledge (P)

- knows "how"
- performs algorithms, computations
- uses formulas
- performs constructions, conversions, order of operations
- uses calculators and computers

Conceptual Understanding (U)

- knows "why", "when", and "knows that he or she knows"
- understands basic mathematical concepts
- understands relationships among number systems, operations, number forms, (fractions, decimals, powers, etc.), concrete, pictorial, and symbolic representation
- understands place value
- understands ratio and (direct) proportion
- understands relationships within formula
- understands relationship among geometric forms
- understands relationship among numbers and geometric forms.

Problem Solving (PS)

- understands definition of stages
- uses a variety of strategies
- applies mathematics knowledge in unfamiliar situations

Quantitative Literacy (Q)

- knows basic facts
- understands place value
- judges reasonableness of a solution
- formulates an approximation of an outcome
- knows and applies mental computation and estimation strategies

PERFORMANCE STANDARDS

Purpose of Performance Standards

The Grade 9 performance standards statements are intended to help educators develop a shared, province-wide understanding of *acceptable* and *excellent* standards for Grade 9 Mathematics.

Presented on the following pages are **DRAFT** statements that describe what is expected of Grade 9 students who are achieving at the *acceptable* or at the *excellent* standard on independent work at the end of the Grade 9 Mathematics program. Once finalized, these statements will represent the standards against which provincial and/or local levels of student achievement will be measured. By comparing actual provincial results to expected provincial standards, decisions can be made about whether achievement is in fact "good enough". The standards inherent in these statements are derived from the goals and objectives of Grade 9 Mathematics as presented in the *1988 Teacher Resource Manual, Junior High Mathematics.*

Target Group

The Grade 9 Mathematics course is intended for all students who have been determined by their teachers to be ready for the regular Grade 9 Mathematics program after having successfully completed the Grade 8 program. The standards described below and on page 20, inherent in the Grade 9 mathematics course are for this target group.

Acceptable Standard of Performance

Students who are achieving at the *acceptable* standard in Grade 9 Mathematics are expected to have a somewhat narrow understanding of the conceptual and procedural knowledge that is essential to the Junior High mathematics program. For example, they may know how to do routine procedures but have difficulty in applying these procedures to problem situations or explaining why these procedures work. Students may be able to estimate and calculate square root, for example, but have difficulty explaining how square root is derived using manipulatives, pictures, or words.

For their performance to be considered *acceptable*, students are expected to be reasonably proficient in their ability to use what they know to perform the mathematical operations and procedures that are fundamental to the program. Their ability to apply what they know and can do to solve both textbook and real-life problems may be somewhat more limited, however, because of their narrow understanding and limited ability to use the conceptual and procedural knowledge in the program. For example, such students must be able to connect basic concepts and skills in simple and multistep problems. These students must also be able to solve routine equations and apply a given formula; however, they may have difficulty in transferring these concepts to word problems or real-life problems.

Standard of Excellence

It is expected that students achieving at the standard of *excellence* in Grade 9 Mathematics have internalized the mathematical concepts as outlined in the mathematics curriculum. These students are expected to have an accurate and broad understanding of the conceptual and procedural knowledge that is essential to succeed in the program. In most cases, these students can easily demonstrate their mathematical knowledge and understanding in concrete, pictorial, and symbolic contexts. These students also have the confidence and ability to transfer their mathematical understanding and make the necessary connections to novel and real-life situations.

Students achieving the standard of *excellence* have a well-developed sense of number. They have more success in estimation and they know whether or not an answer to a calculation makes sense. These students are more likely to monitor their work regularly and more likely to be able to verbalize mathematical situations clearly, using correct technical terms, than students who are achieving at the acceptable standard. They seem to have a better sense of logic and are more successful with abstract number patterns. They are expected not to give up readily when challenged with a complex novel problems, because past successes are their encouragement to persevere.

ALBERTA EDUCATION CONTACTS

Questions or comments regarding this bulletin should be directed to:

Nola Aitken
Mathematics
Test Development Specialist
Achievement Testing Program
Student Evaluation Branch
Alberta Education
11160 Jasper Avenue
Edmonton, Alberta
T5K 0L2

Telephone: 427-0010
FAX: 422-4200

or to the nearest Alberta Education Regional Office:

Grande Prairie Regional Office
#25, 12th Floor, 214 Place
9909 - 102 Street
Grande Prairie, Alberta
T8V 2V4

Telephone: 538-5130

Edmonton Regional Office
7th Floor, Westcor Building
12323 Stony Plain Road
Edmonton, Alberta
T5N 3Y5

Telephone: 427-2952

Calgary Regional Office
12 Floor, Rocky Mountain Plaza
615 Macleod Trail, SE
Calgary, Alberta
T2G 4T8

Telephone: 297-6353

Red Deer Regional Office
3 Floor West, Provincial Building
4920 - 51 Street
Red Deer, Alberta
T4N 6K8

Telephone: 340-5262

Lethbridge Regional Office
200 - 5th Avenue, South
Lethbridge, Alberta
T1J 4C7

Telephone: 381-5243